UNIVERSITY OF FORT HARE

Data Structures and Algorithms

DEGREE EXAMINATIONS

SUPPLEMENTARY EXAMINATION

2019

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Time: **3 hours**

Subject: CSC 223

Marks: **100**

This paper consists of 3 pages including the cover page

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INSTRUCTIONS

- Read each question carefully before attempting it.
- Marks for each question are given to show the weight for each answer required.
- Answer all questions
- Full credit will be given for **100 MARKS**
- Calculators may be used in this examination paper

Question 1[25 Marks]

1.1. Define algorithm complexity and why it is important [5]
1.2. Explain why the complexity of a linear search is O(n). [5]
1.3. Explain the advantages of using hash table data structure over arrays and linked lists. [5]
1.4. Explain the concept of chaining in a hash table. [5]
1.5. Give two examples where hash tables could be used to store data. [5]

Question 2[25 Marks]

2.1. Consider the list of numbers below
50,45,34,56,23,14,25,12,10,-1,78,55,89,86,67,53,45,41,46,9,34

a. Write a program that can be used to build the a binary tree based on the above numbers [5]
b. Build a tree based on the above numbers [5]
c. List the numbers using the
   i. Post order [5]
   ii. Pre order [5]
   iii. In order algorithms [5]
   NB for each order provide the appropriate code.

Question 3[25 marks]

3.1. Using a dynamic stack, write a program that reads a list of integers from a file and prints them out backwards. Your program should include the declaration of

a) structure [3]
b) class [2]
c) appropriate definition for each declared member function of a class [10]
d) the main function that makes use of the class member functions to display the integers in reverse order. [5]
e) Explain with examples, how problems of a linear queue could be solved by a circular queue[5]

Question 4[25 Marks]

4.1. Consider a stack of numbers below

Index	0	1	2	3	sub	5	6	7	8	9
Elements	45	78	89	90	45	67	78	34	38	87

a. Describe the effect of inserting and deleting an element in the index sub. [6]
b. Write the appropriate code for each operation in (a) above. [4]
c. Consider the code segment below

```
voidCircularQueue:: enqueue(int x) {
 if (!is_full()) {
if (is_empty())
{ cqueue[0] = x; front = 0; back = 0; }
 else { back ++;
if(back == MAX) back = 0;
cqueue[back] = x; } size++; } }
```

Give a brief description of the effect of the above code segment when executed. [5]

4.2. Consider the code segment below

```
for(int I =0; i<n; i++)
{for int j = 0 ; j<m, J+3)
cout<< "Hie";
for(int h = 0; h<b; h*2)
cout<< "Hie There";
```

a. Determine the complexity of the above algorithm. [4]

b. Given a list of numbers: {7, 34, 6, 23, 9 ,28, 78, 32, 60}, show how you would sort these numbers using the following algorithm:

   i. Insertion sort [3]

c. Given a list of numbers: {38, 27, 43, 3, 9 ,82, 10}, show how you would sort these numbers using the following algorithm:

   ii. Merge sort [3]

END